

CLAIMS

1. A solid electrolytic capacitor comprising:

a capacitor element having an anode and a cathode;

a base sheet member having an obverse surface for mounting the capacitor element and a reverse surface opposite to the obverse surface;

a protection package formed on the obverse surface of the sheet member to enclose the capacitor element, the package having a first side surface adjacent to the anode of the capacitor element and a second side surface opposite to the first side surface;

a conductive outer anode layer electrically connected to the anode of the capacitor element; and

a conductive outer cathode layer electrically connected to the cathode of the capacitor element;

wherein the outer anode layer is formed on at least either one of the package and the sheet member, the outer cathode layer being formed on at least either one of the package and the sheet member.

2. The solid electrolytic capacitor according to claim 1, further comprising an upper sheet member for shielding the capacitor element, the capacitor element being arranged between the base sheet member and the upper sheet member.

3. The solid electrolytic capacitor according to claim 1, wherein the package is formed with an at least partially slanted portion.

4. The solid electrolytic capacitor according to claim 1, wherein the outer anode layer is formed on at least either one of the first side surface of the package and the reverse surface of the base sheet member, the outer cathode layer
5 being formed on at least either one of the second side surface of the package and the reverse surface of the base sheet member.

5. The solid electrolytic capacitor according to claim 4, wherein the anode is exposed at the first side surface of the package to come into contact with the outer anode layer.

6. The solid electrolytic capacitor according to claim 4, further comprising a metal piece attached to the anode of the capacitor element, the metal piece being exposed at the first side surface of the package to come into contact with the
5 outer anode layer.

7. The solid electrolytic capacitor according to claim 4, further comprising a metal piece attached to the anode of the capacitor element and an anode connection layer formed on the obverse surface of the base sheet member, the anode connection
5 layer being connected to the metal piece and exposed at the

first side surface of the package to come into contact with the outer anode layer.

8. The solid electrolytic capacitor according to claim 4, further comprising a metal piece attached to the anode of the capacitor element and an anode connection layer formed on the obverse surface of the base sheet member, the metal piece
5 being connected to the anode connection layer, the base sheet member being formed with a through-hole for connecting the anode connection layer to the outer anode layer.

9. The solid electrolytic capacitor according to claim 5, further comprising a cathode connection layer formed on the obverse surface of the base sheet member and connected to the cathode of the capacitor element, the cathode connection layer
5 being exposed at the second side surface of the package to come into contact with the outer cathode layer.

10. The solid electrolytic capacitor according to claim 5, further comprising a cathode bump arranged on the cathode of the capacitor element, the cathode bump being exposed at the second side surface of the package to come into contact with
5 the outer cathode layer.

11. The solid electrolytic capacitor according to claim 5, further comprising a cathode connection layer formed on the obverse surface of the base sheet member and connected to the

cathode of the capacitor element, the base sheet member being
5 formed with a through-hole for connecting the cathode
connection layer to the outer cathode layer.

12. A method of making a solid electrolytic capacitor
comprising the steps of:

preparing a sheet member having an obverse surface and a
reverse surface, the obverse surface being provided with at
5 least one cathode connection layer;

placing a capacitor element having an anode and a cathode
onto the obverse surface of the sheet member so that the
cathode of the capacitor element comes into contact with the
cathode connection layer;

10 forming a resin plate on the obverse surface of the sheet
member to enclose the capacitor element;

cutting the resin plate to generate a first cut surface
and a second cut surface, the anode of the capacitor element
being exposed at the first cut surface, the cathode connection
15 layer being exposed at the second cut surface;

forming an anode terminal layer on the first cut surface;

forming a cathode terminal layer on the second cut
surface; and

cutting the resin plate to provide a product capacitor.

13. The method according to claim 12, wherein at least either
one of the first and the second cut surfaces includes an at
least partially slanted portion.

14. A method of making a solid electrolytic capacitor comprising the steps of:

preparing a sheet member having an obverse surface and a reverse surface, the obverse surface being provided with at least one cathode connection layer, the reverse surface being provided with at least one cathode electrode layer, the sheet member being formed with a through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

placing a capacitor element having an anode and a cathode onto the obverse surface of the sheet member so that the cathode of the capacitor element comes into contact with the cathode connection layer;

forming a resin plate on the obverse surface of the sheet member to enclose the capacitor element;

cutting the resin plate to generate a first cut surface and a second cut surface, the anode of the capacitor element being exposed at the first cut surface;

forming an anode terminal layer on the first cut surface;

and

cutting the resin plate to provide a product capacitor.

15. A method of making a solid electrolytic capacitor comprising the steps of:

preparing a sheet member having an obverse surface and a reverse surface, the obverse surface being provided with at least one cathode connection layer;

preparing at least one capacitor element having an anode and a cathode;

attaching a metal piece to the anode of the capacitor element;

10 placing the capacitor element onto the obverse surface of the sheet member so that the cathode of the capacitor element comes into contact with the cathode connection layer;

forming a resin plate on the obverse surface of the sheet member to enclose the capacitor element;

15 cutting the resin plate to generate a first cut surface and a second cut surface, the metal piece of the capacitor element being exposed at the first cut surface, the cathode connection layer being exposed at the second cut surface;

forming an anode terminal layer on the first cut surface;

20 forming a cathode terminal layer on the second cut surface; and

cutting the resin plate to provide a product capacitor.

16. A method of making a solid electrolytic capacitor comprising the steps of:

5 preparing a sheet member having an obverse surface and a reverse surface, the obverse surface being provided with at least one cathode connection layer, the reverse surface being provided with at least one cathode electrode layer, the sheet member being formed with an through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

10 preparing a capacitor element having an anode and a cathode;

attaching a metal piece to the anode of the capacitor element;

15 placing the capacitor element onto the obverse surface of the sheet member so that the cathode of the capacitor element comes into contact with the cathode connection layer;

forming a resin plate on the obverse surface of the sheet member to enclose the capacitor element;

20 cutting the resin plate to generate a first cut surface and a second cut surface, the metal piece of the capacitor element being exposed at the first cut surface;

forming an anode terminal layer on the first cut surface; and

cutting the resin plate to provide a product capacitor.

17. A method of making a solid electrolytic capacitor comprising the steps of:

preparing a capacitor element having an anode, a cathode and a cathode bump formed on the cathode;

5 placing the capacitor element onto a sheet member;

forming a resin plate on the sheet member to enclose the capacitor element;

10 cutting the resin plate to generate a first cut surface and a second cut surface, the anode of the capacitor element being exposed at the first cut surface, the cathode bump being exposed at the second cut surface;

forming an anode terminal layer on the first cut surface;
forming a cathode terminal layer on the second cut
surface; and

15 cutting the resin plate to provide a product capacitor.

18. A method of making a solid electrolytic capacitor
comprising the steps of:

preparing a capacitor element provided with a cathode, a
cathode bump formed on the cathode, an anode, and a metal
5 piece attached to the anode;

placing the capacitor element onto a sheet member;

forming a resin plate on the sheet member to enclose the
capacitor element;

cutting the resin plate to generate a first cut surface
10 and a second cut surface, the metal piece of the capacitor
element being exposed at the first cut surface, the cathode
bump being exposed at the second cut surface;

forming an anode terminal layer on the first cut surface;

forming a cathode terminal layer on the second cut
15 surface; and

cutting the resin plate to provide a product capacitor.

19. A method of making a solid electrolytic capacitor
comprising the steps of:

preparing a lower sheet member having an obverse surface
and a reverse surface, the obverse surface being provided with

5 at least one cathode connection layer;

placing a capacitor element having an anode and a cathode onto the obverse surface of the lower sheet member so that the cathode of the capacitor element comes into contact with the cathode connection layer;

- 10 stacking an upper sheet member on the capacitor element;
 supplying a resin material into a space between the lower
 and the upper sheet members to enclose the capacitor element;
 hardening the supplied resin material to form a resin
 plate attached to the lower and the upper sheet members, the
15 resin plate and the lower and the upper sheet members
 constituting a plate assembly;
 cutting the plate assembly to generate a first cut
 surface and a second cut surface, the anode of the capacitor
 element being exposed at the first cut surface, the cathode
20 connection layer being exposed at the second cut surface;
 forming an anode terminal layer on the first cut surface;
 forming a cathode terminal layer on the second cut
 surface; and
 cutting the plate assembly to provide a product
25 capacitor.

20. A method of making a solid electrolytic capacitor comprising the steps of:

- 5 preparing a lower sheet member having an obverse surface
 and a reverse surface, the obverse surface being provided with
 at least one cathode connection layer, the reverse surface
 being provided with at least one cathode electrode layer, the

lower sheet member being formed with a through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

10 placing a capacitor element having an anode and a cathode onto the obverse surface of the sheet member so that the cathode of the capacitor element comes into contact with the cathode connection layer;

 stacking an upper sheet member on the capacitor element;

15 supplying a resin material into a space between the lower and the upper sheet members to enclose the capacitor element;

 hardening the supplied resin material to form a resin plate attached to the lower and the upper sheet members, the resin plate and the lower and the upper sheet members
20 constituting a plate assembly;

 cutting the plate assembly to generate a first cut surface and a second cut surface, the anode of the capacitor element being exposed at the first cut surface;

 forming an anode terminal layer on the first cut surface;

25 and

 cutting the plate assembly to provide a product capacitor.

21. A method of making a solid electrolytic capacitor comprising the steps of:

 preparing a lower sheet member having an obverse surface and a reverse surface, the obverse surface being provided with
5 at least one cathode connection layer;

preparing a capacitor element having a cathode, an anode,
and a metal piece attached to the anode;

placing the capacitor element onto the obverse surface of
the lower sheet member so that the cathode of the capacitor

10 element comes into contact with the cathode connection layer;

stacking an upper sheet member on the capacitor element;

supplying a resin material into a space between the lower
and the upper sheet members to enclose the capacitor element;

15 hardening the supplied resin material to form a resin
plate attached to the lower and the upper sheet members, the
resin plate and the lower and the upper sheet members
constituting a plate assembly;

cutting the plate assembly to generate a first cut
surface and a second cut surface, the metal piece of the
20 capacitor element being exposed at the first cut surface, the
cathode connection layer being exposed at the second cut
surface;

forming an anode terminal layer on the first cut surface;

25 forming a cathode terminal layer on the second cut
surface; and

cutting the plate assembly to provide a product
capacitor.

22. A method of making a solid electrolytic capacitor
comprising the steps of:

preparing a capacitor element having an anode, a cathode
and a cathode bump formed on the cathode;

5 placing the capacitor element onto a lower sheet member;
stacking an upper sheet member on the capacitor element;
supplying a resin material into a space between the lower
and the upper sheet members to enclose the capacitor element;
hardening the supplied resin material to form a resin
10 plate attached to the lower and the upper sheet members, the
resin plate and the lower and the upper sheet members
constituting a plate assembly;
cutting the plate assembly to generate a first cut
surface and a second cut surface, the anode of the capacitor
15 element being exposed at the first cut surface, the cathode
bump being exposed at the second cut surface;
forming an anode terminal layer on the first cut surface;
forming a cathode terminal layer on the second cut
surface; and
20 cutting the plate assembly to provide a product
capacitor.

23. A method of making a solid electrolytic capacitor element
comprising the steps of:

5 preparing a capacitor element provided with a cathode, a
cathode bump formed on the cathode, an anode, and a metal
piece attached to the anode;
placing the capacitor element onto a lower sheet member;
stacking an upper sheet member on the capacitor element;
supplying a resin material into a space between the lower
and the upper sheet members to enclose the capacitor element;

10 hardening the supplied resin material to form a resin plate attached to the lower and the upper sheet members, the resin plate and the lower and the upper sheet members constituting a plate assembly;

15 cutting the plate assembly to generate a first cut surface and a second cut surface, the metal piece of the capacitor element being exposed at the first cut surface, the cathode bump being exposed at the second cut surface;

 forming an anode terminal layer on the first cut surface;

20 forming a cathode terminal layer on the second cut surface; and

 cutting the plate assembly to provide a product capacitor.

24. A method of making a solid electrolytic capacitor comprising the steps of:

5 preparing a sheet member having an obverse surface and a reverse surface, the obverse surface being formed with at least one pair of an anode connection layer and a cathode connection layer, the reverse surface being formed with at least one pair of an anode electrode layer and a cathode electrode layer, the sheet member being formed with a first through-hole for electrically connecting the anode connection layer to the anode electrode layer and with a second through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

10 placing a capacitor element having an anode and a cathode

onto the obverse surface of the sheet member so that the
15 cathode of the capacitor element comes into contact with the
cathode connection layer;

forming a resin plate on the obverse surface of the sheet
member to enclose the capacitor element; and

cutting the resin plate to provide a product capacitor.

25. A method of making a solid electrolytic capacitor
comprising the steps of:

preparing a sheet member having an obverse surface and a
reverse surface, the obverse surface being formed with at
least one pair of an anode connection layer and a cathode
connection layer, the reverse surface being formed with at
least one pair of an anode electrode layer and a cathode
electrode layer, the sheet member being formed with a first
through-hole for electrically connecting the anode connection
10 layer to the anode electrode layer and with a second through-
hole for electrically connecting the cathode connection layer
to the cathode electrode layer;

preparing a capacitor element having an anode, a cathode
and a metal piece attached to the anode;

15 placing the capacitor element onto the sheet member so
that the metal piece comes into contact with the anode
connection layer and that the cathode comes into contact with
the cathode connection layer;

forming a resin plate on the sheet member to enclose the
20 capacitor element; and

cutting the resin plate to provide a product capacitor.

26. A method of making a solid electrolytic capacitor comprising the steps of:

preparing a lower sheet member having an obverse surface and a reverse surface, the obverse surface being formed with at lease one pair of an anode connection layer and a cathode connection layer, the reverse surface being formed with at least one pair of an anode electrode layer and a cathode electrode layer, the lower sheet member being formed with a first through-hole for electrically connecting the anode connection layer to the anode electrode layer and with a second through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

placing a capacitor element having an anode and a cathode onto the lower sheet member so that the anode comes into contact with the anode connection layer and that the cathode comes into contact with the cathode connection layer;

stacking an upper sheet member on the capacitor element;

supplying a resin material into a space between the lower and the upper sheet members to enclose the capacitor element;

hardening the supplied resin material to form a resin plate attached to the lower and the upper sheet members, the resin plate and the lower and the upper sheet members constituting a plate assembly; and

cutting the plate assembly to provide a product capacitor.

27. A method of making a solid electrolytic capacitor comprising the steps of:

preparing a lower sheet member having an obverse surface and a reverse surface, the obverse surface being formed with at least one pair of an anode connection layer and a cathode connection layer, the reverse surface being formed with at least one pair of an anode electrode layer and a cathode electrode layer, the lower sheet member being formed with a first through-hole for electrically connecting the anode connection layer to the anode electrode layer and with a second through-hole for electrically connecting the cathode connection layer to the cathode electrode layer;

preparing a capacitor element having an anode, a cathode and a metal piece attached to the anode;

placing the capacitor element onto the lower sheet member so that the metal piece comes into contact with the anode connection layer and that the cathode comes into contact with the cathode connection layer;

stacking an upper sheet member on the capacitor element;

supplying a resin material into a space between the lower and the upper sheet members to enclose the capacitor element;

hardening the supplied resin material to form a resin plate attached to the lower and the upper sheet members, the resin plate and the lower and the upper sheet members constituting a plate assembly; and

cutting the plate assembly to provide a product capacitor.